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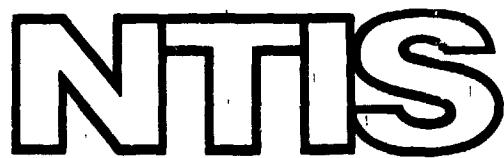
**A METHOD OF PRODUCING PROTECTIVE GREASE**

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**Foreign Technology Division  
Wright-Patterson Air Force Base, Ohio**

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## FOREIGN TECHNOLOGY DIVISION



A METHOD OF PRODUCING PROTECTIVE  
GREASE

by

G. I. Buklan and L. I. Pyasetskaya



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13. ABSTRACT

1. The method of producing a protective grease by means of thickening its base is distinguished by the fact that an epoxy compound containing epoxy resin and polyethylene polyamine is used as a thickening agent for the purpose of increasing the effectiveness of the grease. 2. The method according to par. 1 is distinguished by the fact that the base of the grease is thickened by 29-31% epoxy compound containing 100 pbw of epoxy resin and 10-12 pbw of polyethylene polyamine.

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| 10.<br>KEY WORDS                           | LINK A |    | LINK B |    | LINK C |    |
|--|--------|----|--------|----|--------|----|
|  | ROLE   | WT | ROLE   | WT | ROLE   | WT |
| Grease<br>Corrosion Resistance<br>Chlorine |        |    |        |    |        |    |

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## EDITED TRANSLATION

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### A METHOD OF PRODUCING PROTECTIVE GREASE

By: G. I. Buklan and L. I. Pyasetskaya

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| А а   | А а    | А, а            | Р р   | Р р    | Р, р            |
| Б б   | Б б    | Б, б            | С с   | С с    | С, с            |
| В в   | В в    | В, в            | Т т   | Т т    | Т, т            |
| Г г   | Г г    | Г, г            | У у   | У у    | У, у            |
| Д д   | Д д    | Д, д            | Ф ф   | Ф ф    | Ф, ф            |
| Е е   | Е е    | Ye, ye; E, e*   | Х х   | Х х    | Kh, kh          |
| Ж ж   | Ж ж    | Zh, zh          | Ц ц   | Ц ц    | Ts, ts          |
| З з   | З з    | Z, z            | Ч ч   | Ч ч    | Ch, ch          |
| И и   | И и    | I, i            | Ш ш   | Ш ш    | Sh, sh          |
| Я я   | Я я    | Y, y            | Щ щ   | Щ щ    | Sheh, shch      |
| К к   | К к    | K, k            | Ь ь   | Ь ь    | "               |
| Л л   | Л л    | L, l            | Ы ы   | Ы ы    | Y, y            |
| М м   | М м    | M, m            | Ь ь   | Ь ь    | '               |
| Н н   | Н н    | N, n            | Э э   | Э э    | E, e            |
| О о   | О о    | O, o            | Ю ю   | Ю ю    | Yu, yu          |
| П п   | П п    | Р, р            | Я я   | Я я    | Ya, ya          |

\* ye initially, after vowels, and after ъ, ъ; е elsewhere.  
 When written as є in Russian, transliterate as yє or є.  
 The use of diacritical marks is preferred, but such marks  
 may be omitted when expediency dictates.

## A METHOD OF PRODUCING PROTECTIVE GREASE

G. I. Buklan and L. I. Pyasetskaya

The invention deals with the production of greases used as protection against corrosion of metallic structures, machines and mechanisms in aggressive media.

Methods are known for producing greases stable in aggressive media by introducing various types of thickeners--soaps of fatty acids, solid hydrocarbons, organic and inorganic substances [for example, [PVK] (ПВЧ) grease ([GOST] (ГОСТ) 10586-65) made by thickening of cylinder oil 11 (25-35%) with petrolatum (60-70%) and ceresin (4%)]. Greases produced by these methods have in certain cases low dropping points (35-50°C), as a result of which they are not able to protect the metallic surfaces of machines and mechanisms from corrosion when these surfaces during operation are heated to temperatures of 100-120°C; in other cases these greases have insufficient protective properties at satisfactory creep temperatures.

The purpose of the proposed method is the preparation of a grease with increased corrosion resistance and a dropping point of the order of 100-120°C. This can be achieved by thickening the existing liquia lubricant, Neftegaz-204u [MRTU-124(Inter-Republic Technical Specifications) No. 60-63] with 29-31% epoxy compound. The epoxy compound contains 100 pbw of epoxy resin ED-6 and 10-12 pbw of polyethylenepolyamine.

The ES-6 epoxy resin is thoroughly heated at 100-120°C in order to remove the existing moisture from it. An indication for terminating the heating is the absence of small bubbles at the surface of the resin. Then the epoxy resin is cooled to a temperature of 33-37°C and a hardener--10-12 pbw of polyethylene polyamine--is added to it. The mixture of ED-6 epoxy resin and polyethylene polyamine is thoroughly blended until a homogeneous mass is obtained. As soon as the blending is accomplished, 29-31 wt % of the epoxy compound is immediately added to the Neftegaz-204u (NG-204u) liquid lubricant, having a temperature of 18-25°C. The mixture of grease and compound is thoroughly blended.

Example. 100 pbw of ED-6 epoxy resin is heated to 110°C for 40 min until all the moisture is removed. Then the resin is cooled to 33-37°C and 12 pbw of polyethylene polyamine are added to it, while mixing. The mixing is continued until a homogeneous mass is obtained. A quantity of the obtained epoxy compound 30 wt %, is mixed with a quantity of Neftegaz-204u liquid lubricant, 70 wt %, at a temperature of 21°C. The mixture is thoroughly blended.

The epoxy compound, when being mixed with the Neftegaz-204u liquid lubricant, initially exhibits an increase in viscosity. The color of the mixture in this case remains somewhat lighter than the color of the original grease. Further mixing lowers the viscosity of the mixture, reaching the value of the original viscosity of the Neftegaz-204u liquid lubricant. The mixture here exhibits a light chocolate color. The homogeneity of the mass based on viscosity and color serves as an indication for the termination of the mixing of the thickened grease.

The color should be light chocolate. In order to complete the thickening process, the grease is kept at room temperature without mixing for 7 days.

The internal appearance of the prepared grease is that of a highly viscous paste of light chocolate color. The grease prepared

according to the proposed method is characterized by the following properties.

The colloidal stability of the grease does not change during storage, and separation of the oil does not occur. The time of testing is 6 months.

Under the effect of mechanical action (mixing) the grease liquefies, which facilitates its application on metallic surfaces.

The dropping point of the grease in a layer 0.2-0.4 mm thick from vertical metallic surfaces is of the order of 100-120°C. During storage and under the effect of mechanical action the dropping point of the grease does not change. The maximum temperature for the use of the grease is limited by the vaporization temperature of the nitrated oil which is used in the manufacturing of the Neftegaz-204u liquid lubricant.

A layer of grease 0.2-0.4 mm thick provides reliable protection against corrosion of metallic surfaces in the following aggressive media:

a) at a concentration 20 times that of the permissible health norm, g/m<sup>3</sup>:

|                  |      |
|------------------|------|
| Chlorine         | 0.02 |
| Nitric anhydride | 0.1  |

b) at a concentration 40 times that of the permissible health norm, g/m<sup>3</sup>:

|                     |      |
|---------------------|------|
| Hydrogen chloride   | 0.2  |
| Sulfuric anhydride  | 0.04 |
| Sulfurous anhydride | 0.4  |

Table

| (a)                   | Хористый | (b) волокр                   | (c) Окисы азота   | (d) Серный ангидрид          | (e) Сернистый ангирид | (f) Хлор                     |
|-----------------------|----------|------------------------------|-------------------|------------------------------|-----------------------|------------------------------|
|                       | Смазка   | Прокор-<br>родиро-<br>вавшая | Толщи-<br>на слоя | Прокор-<br>родиро-<br>вавшая | Толщи-<br>на слоя     | Прокор-<br>родиро-<br>вавшая |
| (1) <b>Цемент</b>     | —        | 5-10                         | 0,2               | 0                            | 0,2                   | 0                            |
| (2) <b>TSIATIM-21</b> | 0,25     | 50                           | 0,42              | 1                            | 0,73                  | 0                            |
| (3) <b>TSIATIM-21</b> | 0,08     | 100                          | 0,04              | 0                            | 0,03                  | 300                          |
| (4) <b>НГ-304</b>     | 0,17     | 100                          | 0,1               | 0                            | 0,39                  | 0                            |

| (a)                   | Хористый          | (b) волокр                   | (c) Окисы азота   | (d) Серный ангидрид          | (e) Сернистый ангирид | (f) Хлор                     |
|-----------------------|-------------------|------------------------------|-------------------|------------------------------|-----------------------|------------------------------|
| (g)                   | Толщи-<br>на слоя | Прокор-<br>родиро-<br>вавшая | Толщи-<br>на слоя | Прокор-<br>родиро-<br>вавшая | Толщи-<br>на слоя     | Прокор-<br>родиро-<br>вавшая |
| (1) <b>Цемент</b>     | —                 | 5-10                         | 0,2               | 0                            | 0,2                   | 0                            |
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| (3) <b>TSIATIM-21</b> | 0,08              | 100                          | 0,04              | 0                            | 0,03                  | 300                          |
| (4) <b>НГ-304</b>     | 0,17              | 100                          | 0,1               | 0                            | 0,39                  | 0                            |

KEY: (a) Grease; (b) Hydrogen chloride; (c) Nitrogen oxides; (d) Sulfuric anhydride; (e) Sulfurous anhydride; (f) Chlorine; (g) Thickness of the layer of grease, mm; (h) Corroded surface, %; (i) Proposed; (j) Proposed; (k) NG-204u; (l) NG-204.

The testing was conducted at a temperature of 40°C for 8 hours with subsequent cooling at 20°C for 16 hours. The relative humidity was 90 + 3% at 20°C for atmospheres containing nitrogen oxides, sulfurous anhydride and chlorine. The test duration was 15 days. The results of the tests on greases applied to the surface of steel specimens in an aggressive media at a 20-fold concentration are presented in the table.

#### OBJECT OF THE INVENTION

1. The method of producing a protective grease by means of thickening its base is distinguished by the fact that an epoxy compound containing epoxy resin and polyethylene polyamine is used as a thickening agent for the purpose of increasing the effectiveness of the grease.
2. The method according to par. 1 is distinguished by the fact that the base of the grease is thickened by 29-31% epoxy compound containing 100 pbw of epoxy resin and 10-12 pbw of polyethylene polyamine.